

US-PAT-NO: 6415227

DOCUMENT-IDENTIFIER: US 6415227 B1

TITLE: Enhanced global positioning system and map
navigation process

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INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP |
|-----------------|------------|-------|-----|
| CODE COUNTRY | | | |
| Lin; Ching-Fang | Chatsworth | CA | N/A |
| N/A | | | |

US-CL-CURRENT: 701/213, 340/988 , 340/990 , 342/357.01 , 342/357.06
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707/100

ABSTRACT:

An enhanced global positioning system and map navigation process, which incorporates the GPS position data and geospatial map data. This enhanced navigation process includes GPS-based efficient geospatial database access and query and a time-space filtering method to fully fuse the GPS position data and the geospatial map data to obtain enhanced navigation performance. The system features both portability and ease-of-use. It also accommodates mission specific database creation and value-adding techniques. The system includes personal navigation, land vehicle navigation, marine navigation, etc.

42 Claims, 8 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 8

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Drawing Description Text - DRTX (4):

FIG. 3 is a block diagram delineating the hierarchy structure of a geospatial map database which is used with a GPS receiver for enhanced navigation process.

Detailed Description Text - DETX (7):

The operational interface 10 provides the user with entry of commands. The operational interface 10 includes a touch screen with which the user can use his finger or a stylus to operate the embedded software, for example to perform database query. The operational interface 10 can also be enhanced by a soft keyboard with which the user can input commands exactly like the keyboard of a desktop computer. The operational interface 10 can also be a handwriting recognition system. The user just write the commands on the screen to input commands. The friendly integrated functional menu 20 provides the user with involved navigation and database query functions, including map viewer, trip scheduler, GPS navigator, street locator, snap router, and information query. The map viewer shows an electronic map on the screen of a computer to show where the user is. The user can use scroll bar to roam the map. The trip scheduler provides trip planning function for the user. The GPS navigator provides the user with real-time navigation information, including position, velocity, and heading. This GPS navigator has a communication interface 37 with a GPS receiver to get the GPS data. The street locator provides user with capability to find an address of interest. The snap router provides the user with optimized time-based or cost-based routes. For example, a delivery company will make delivery to multiple customers at the same time. The deliverer can use this snap router to obtain a delivery route based on shortest time consuming or a cheapest route, such as avoiding toll freeway.

Detailed Description Text - DETX (48):

with a BOOL value output. When the given database is involved, the BOOL is TRUE (1) or the BOOL is FALSE (0). The symbol .times. represents the following operations:

Detailed Description Text - DETX (51):

with a BOOL value output. When the given tile is involved, the BOOL is TRUE (1) or FALSE (0). The symbol .times. conforms to the operations given

by
Equation (11).

Detailed Description Text - DETX (58):

with a BOOL value output. When the given edge is involved, the BOOL is TRUE

(1) or FALSE (0). The operator .times. conforms to the following operation:

Detailed Description Text - DETX (61):

with a BOOL value output. When the given face is involved, the BOOL is TRUE

(1) or FALSE (0). The operator .times. conforms to the operation given by Equation (15).

Detailed Description Text - DETX (70):

with a BOOL value output. In Formula (18) the number n represents the total number of databases involved. When the primitive queried is contained in the database, the BOOL is to TRUE (1). When the primitive queried is not contained in the database, the BOOL is FALSE (0). The symbol o represents the following operations:

Detailed Description Text - DETX (75):

with a BOOL value output. When the primitive queried is contained in the tile, the BOOL is set to TRUE (1), else the BOOL is FALSE (0). The symbol o represents the operations given by Formula (19).

Detailed Description Text - DETX (104):

The position sensor provides the user's current position and velocity. The position sensor 50 can be a GPS receiver. Based on the measurements of the current position and velocity the user's next position and velocity are estimated and predicted in the position estimation and prediction module 422.

The predicted user's next position is output to the map matching process module

423. The road retrieval module 421 obtains the road information in the vicinity of the user from the geospatial database 38. The road data is output

the map matching process module 423. The map matching process also receives

the user's position measured by the position sensor.

Detailed Description Text - DETX (118):

(b-1) defining an access area based on the position from the position determination device and a geographic extent, wherein the position from the position determination device is a center of the access area, and the geographic extent is input by the user;

Detailed Description Text - DETX (129):

(2) an operational interface 10, which provides a command input method for a user;

Detailed Description Text - DETX (146):

(2) an operational interface 10, which provides a command input method for the user;

Claims Text - CLTX (9):

(b-1) defining said access area based on said measured position from said global positioning system receiver and said geographic extent, wherein said measured position from said global positioning system receiver is a center of said access area and said geographic extent is input by said user; and

Claims Text - CLTX (25):

(b-1) defining said access area based on said measured position from said global positioning system receiver and said geographic extent, wherein said measured position from said global positioning system receiver is a center of said access area and said geographic extent is input by said user; and

Claims Text - CLTX (41):

(b-1) defining said access area based on said measured position from said global positioning system receiver and said geographic extent, wherein said measured position from said global positioning system receiver is a center of said access area, and said geographic extent is input by said user; and

Claims Text - CLTX (65):

(b-1) defining an access area based on said position from said global

positioning system receiver and a geographic extent, wherein said position from said global positioning system receiver is a center of said access area, and said geographic extent is input by a user;

Claims Text - CLTX (79):

(b-1) defining an access area based on said position from said global positioning system receiver and a geographic extent wherein said position from said global positioning system receiver is a center of said access area, and said geographic extent is input by a user;

Claims Text - CLTX (94):

(b-1) defining an access area based on said position from said global positioning system receiver and a geographic extent, wherein said position from said global positioning system receiver is a center of said access area, and said geographic extent is input by a user;

Claims Text - CLTX (109):

an operational interface for providing a command input method for a user;

Claims Text - CLTX (120):

defining an access area based on said position from said global positioning system receiver and an geographic extent, wherein said position from said global positioning system receiver is a center of said access area and said geographic extent is input by said user;

Claims Text - CLTX (150):

an operational interface for providing a command input method for said user;

Claims Text - CLTX (159):

defining an access area based on said position from said global positioning system receiver and an geographic extent wherein said position from said global positioning system receiver is a center of said access area and said geographic extent is input by said user;